

will be a structure, as we have already said, that advancing science will periodically overthrow. The ruin, however, will not be deplorable, because not only not irreparable, but certain to be succeeded by a new edifice which will in all probability be better and more useful than its predecessor.

J. M. D.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.]

The Education of Women

In your excellent article (vol. x. p. 395) on this subject, you forcibly point out that custom and prejudice have established for boys and girls a curriculum of studies which seems to have but little reason to justify it. You particularly mention that whereas music is, in England, but rarely taught to boys, it is "almost compulsory on girls, whether they have the talent for it or not."

This monopoly of music for girls, supposing our system of education to be founded on reason, should imply, amongst other considerations, that females possess peculiar aptitudes for this branch of art, and that instructing them in it is more likely to produce favourable results in their case than in that of males. I do not say that this is the only probable justification for our practice, but it should certainly be one strong ground for it.

But how does the matter really stand? It is a most remarkable fact that in the highest walk of musical achievement, composition, women are positively nowhere. I believe I am safe in saying that not a single opera, or oratorio, for instance, the work of a woman, has ever maintained even brief popularity; nor has the sex furnished us with one representative worthy of being placed by the side of Bach, Handel, Mozart, Beethoven, Rossini, Mendelssohn, and a host of other great male composers who could be named.

In almost every other department of art and knowledge eminent women have been found—in literature, both prose and poetic, in mathematics, science, painting, sculpture, medicine; but not a solitary great female musical composer can be named.

I do not point out this fact for the purpose of disparaging the female intellect, of which I have the highest admiration, but for the purpose of reinforcing with it the arguments put forward by yourself and other friends of female education in favour of a revision of the subjects appropriated by unreasoning custom to the two sexes.

Considering, however, that the doctrine of chances might have been expected to give us at least one female musician of the highest order out of the myriads who devote a large portion of their existence to the cultivation of the art, the striking fact that it is not so is one well calculated to excite speculation. Is the power of producing new and acceptable music distinguishable in any way from other art power—that for instance of producing a fine painting, statue, or poem? There does seem to me to be this peculiarity belonging to music. The subjects of a painting, statue, or poem, may, and generally are, suggested by some event, person, tradition, or thing already existing. The suggestions of colour, form, light, and shade, furnished by nature, are endless, and capable of infinite diversification—they often, no doubt, act on the mind of the artist unconsciously—but, whether he is conscious of it or not, their influence is always at work—and though he produces something which we feel to be truly original, yet he is probably indebted for the first germ of the idea and for the greater part of the machinery by means of which it has been realised, to sources and materials previously existing, some of which have indeed generally left their traces on the work.

Can anything like this be said of music? What can have suggested some of the simple melodies to which we are never tired of listening, and which are so complete, so consistent, so satisfying, that we accept them almost like works of nature which we do not dream of altering? That there are associations of ideas between musical sounds and visible things, and even moral sentiments, may be true, but such relations must be vagueness and mistiness itself, compared with the relations on which other arts are dependent. So slight, so remote, so intangible are the sources of original music, that it has always seemed to me that the faculty of musical composition of the highest order approaches more nearly to inspiration than any other faculty with which mankind is endowed.

How can the apparent absence of this faculty in women be explained?

ALEX. STRANGE

London, Sept. 22

Double Rainbow

ON the 11th, at 5.40 P.M., this comparatively rare phenomenon was well seen here by the crowd assembled at the Ladies' Golf Match. The accompanying sketch, by T. Hodge, Esq., gives a thoroughly artistic view of the scene.

Unfortunately the estuary of the Eden, whose quiet water furnished the reflected sunlight, is considerably north of the observer's station. Hence the necessary incompleteness of the second bow. I cannot learn whether any spectator was fortunate enough to observe the phenomenon from a point a mile or two north, whence it would probably have been seen entire.

As seen from stations to the eastward of St. Andrews, the second bow, there due to light reflected from the rougher water of the bay, was considerably broader than the first; so much so



at the upper end of the visible portion as to give, even to intelligent spectators, the impression that it was convex instead of concave to the point opposite the reflected sun.

It was not possible to ascertain whether the light of the portions of the two bows visible below the horizon was that coming from the rain-drops directly, or that subsequently reflected from the sea; though (*pace* Dr. Tyndall) probably the latter was at least a considerable agent.

P. G. TAIT

St. Andrews, N.B., Sept. 15

P.S. In my note on "Bright Meteors" (NATURE, vol. x. 305) I find I have inadvertently written Saturday in place of Sunday. Perhaps, with this correction, Mr. Waller may be able to identify both meteors in a satisfactory manner.

THIS is the phenomenon observed by Dr. Halley, Aug. 6, 1698, at Chester. The second bow was formed by the sun's light reflected from the river Dee. See "Brewster's Optics," p. 380.

Of the parts of the two bows below the horizon, the outer is a continuation of the primary bow, and is formed principally by direct sunlight striking the drops between the observer and the sea and reflected in the ordinary manner.

It may derive a slight increase of brightness from light first reflected at the sea, then by rain-drops, and lastly by the sea again. The inner part is produced by one reflection from the sea and one reflection from rain-drops. The brightness will be the same whichever reflection comes first, provided the smooth sea, the rain-drops, and the sunlight are present.

J. CLERK-MAXWELL

Curious Rainbow

I DO not see that the rainbow described by Mr. Swettenham (NATURE, vol. x. p. 398) was different from an ordinary rainbow of moderate brightness, except in there being a slight interval between the two series of colours, which generally blend into

one another. The fainter series are attributed to interference. In bright rainbows there are three, if not four, series of colours, at least in the upper part of the arch, where the colours are always the most distinct, probably owing to the rain-drops being smaller high up, and therefore more perfectly globular. It may not be generally known that a rainbow may be seen much more perfectly in a single drop of dew, by placing the eye close to it, than in rain, and then no less than ten or twelve series of colours may be seen; and in the irregular dew-drops (as also in hoar-frost) a great and very beautiful variety of bows and spectra can be seen.

T. W. BACKHOUSE

Sunderland, Sept 23

I SHOULD like to say a few words regarding Mr. Swettenham's letter (*NATURE*, vol. x. p. 398). The mathematical theory of the rainbow has been worked out pretty completely. We must not look for it, however, in text-books, which generally give a very unsatisfactory account of the rainbow, but in the original memoirs, which sometimes are very difficult to find.

The appearance of coloured bands inside the primary rainbow is not at all of very rare occurrence; since my attention has been drawn to them by a casual observation, I have seen them repeatedly. Only a few weeks ago I saw distinctly three concentric bows, with all the colours inside the primary bow. These bows have been called supernumerary rainbows. The complete mathematical theory has been given by the Astronomer Royal in the *Philosophical Magazine*, and the theory has been verified by Mr. Miller. The cause of these coloured rings is the interference of two rays of light entering the rain-drop at different angles of incidence, but having the same deviation, and therefore leaving the rain-drop parallel to each other. It is clear that two such rays must exist for all deviations from the maximum to the deviation of ray of light having an angle of incidence of 90°.

In text-books no mention is ever made of these supernumerary rainbows, and this is the more to be regretted as the interference mentioned above is, I think, one of the principal causes of its formation.

Were the explanation given in text-books complete, we should not have in the rainbow such pure colours as we actually see, but the yellow would contain a great deal of red, and the green would be contaminated by a great quantity of red and yellow. As it is, however, the red, which would have the same deviation as the green and yellow rays, is destroyed, or nearly so, by interference, which, therefore, is the cause that the colours of the rainbow are nearly pure. What is called the violet of the rainbow is generally the violet mixed with the red of the next supernumerary rainbow. This is not the only instance that text-books contain incomplete accounts of phenomena which have been satisfactorily explained.

ARTHUR SCHUSTER

Sunnyside, Upper Avenue Road

Mist Bows

ON Sept. 14 I was driving from the Lizard just after sunrise with Mr. Lugg of Manaccan. A thick mist covered the fields and moorland. The tops of the farm buildings and corn stacks and the church towers were visible above the sea of mist which, matted on the ground, gave the entire country the appearance of being covered with snow. About 6.30 A.M. the sun was bright on our right hand, and on the left we saw a halo of prismatic colours forming a distinct circle of rainbow at a little distance from and encircling the shadows of our heads, and only broken where the shadows of our bodies interposed. This appearance lasted for ten minutes, and our shadows with their attendant bow showed brightly against the mist background as we passed hedges and fields, and kept pace with us like "the mist raised from the plashy earth" by the hare in Wordsworth's poem,

"That, glittering in the sun,
Runs with her all the way wherever she doth run."

We afterwards opened a valley terminating in an extensive moor, when the mist appeared as a sea of prismatic colour extending to the horizon. About 7 A.M. we saw a perfect bow free from any prismatic colour, both ends of which terminated in the field immediately to our left.

My companion, who is constantly driving about this district in early morning, says he never before saw similar phenomena.

Lizard Signal Station, Sept. 16

HOWARD FOX

Carnivorous Plants—how to be obtained

IT is not unlikely that there may be a great demand for plants of the genus *Drosera*, and as I am in a neighbourhood where

the supply of the *D. rotundifolia* and *D. intermedia* is inexhaustible, I shall be glad to send, through the post, plants of the same to any who are desirous of investigating their carnivorous habits; but to meet the necessary expenses of collecting and postage, six penny stamps must be enclosed in the application for each dozen plants. The applications of dealers in plants will not be attended to.

The *D. intermedia* is far more abundant than the *D. rotundifolia*, and will answer the purpose of investigators quite as well. A few words about the method of growth of these may not be out of place. Pure peat well soaked with water suits either kind, but while the *D. intermedia* flourishes with its roots beneath the surface of the water, *D. rotundifolia* grows best when it is from 3 in. to 4 in. above the surface; now and then it happens that it is found with its roots in the water, and then the hairs on the stalks of the leaves, which constitute one of the distinguishing features between these species, are much diminished, both in number and length.

The Liverpool naturalists will find a large supply of the *D. rotundifolia* on Oxtan Common, and there they are most abundant in the corner nearest to Noctorum Farm. Thurston Hill is another locality in the same neighbourhood where this plant grows.

The *Pinguicula lusitanica* is not uncommon in the bogs of the New Forest, but I cannot promise specimens of this plant with the same certainty as I can those of the *Droseræ*. Applications for plants had better have the word *Drosera* written on the envelope, to prevent the delay which would arise from such letters being forwarded to me when away from the New Forest.

Bisterne Close, Burley, Hants

G. H. HOPKINS

[Both species are moderately abundant, though small, in a peat-bog near Burnham Beeches, Bucks, about four miles from Slough.—ED.]

Automatism of Animals

PROF. HUXLEY'S most interesting address published in *NATURE*, vol. x. p. 362, seems to me to involve some difficulty, which I take the liberty to state, though well aware that I am stepping on slippery ground. I allude to this passage:—"Suppose I had a frog placed in my hand, and that I could make it, by turning my hand, perform this balancing movement. If the frog were a philosopher he might reason thus: 'I feel myself uncomfortable and slipping, and feeling myself uncomfortable I put my legs out to save myself. Knowing that I shall tumble if I do not put them further, I put them further still, and my volition brings about all these beautiful adjustments which result in my sitting safely.' But if the frog so reasoned he would be entirely mistaken, for the frog does the thing just as well when he has no reason, no sensation, no possibility of thought of any kind."

Now, does it unavoidably follow from the latter fact that this philosophising frog would be *entirely* mistaken? What I should venture to object is simply this:—Experiment shows, indeed, that very delicate combinations of muscular actions (as in swimming) are brought about by impressions upon the sensory nerves, even when, after ablation of the brain, there can be no longer any consciousness. But have not those combinations originally arisen during undisturbed consciousness, and therefore, perhaps, under the influence of consciousness, inscrutable as the relation of consciousness to corporeal phenomena is acknowledged to be? And even if the experiments alluded to should succeed with animal individuals which, before vivisection, never had executed the movements in question (and I was once assured by a distinguished physiologist that similar experiments do really succeed with rabbits deprived of part of brain soon after birth), yet those adjustments may be rather considered with regard to the great principle of inheritance, as it has been applied to instincts by Mr. Darwin and Mr. Spencer, and alluded to in Prof. Tyndall's address. Though now performed by animals without possibility of sensation and thought, those movements were adjusted to each other, and to impressions on sensory nerves in these animals' ancestors while in possession of consciousness.

Surely such questions will ever remain doubtful; yet I think it not unbecoming to state a view of them which seems to me to be in accordance with the present direction of biological theories.

I. D. WETTERHAN

Frankfort-on-the-Maine, Sept. 20